## Remarks/Arguments

The Applicant requests the claims following amendment be accepted. Each objection of the 10-30-08 OA is addressed.

### Arguments regarding OA1: Claim 17 is canceled

### Arguments regarding OA 2: Claims 1, 3-5, 10 and 16

1. All claim references to a boron containing fungicide are replaced with a cationic salt of boric acid which removes boric acid from the claims. This eliminates the objection based on Chow.

### Arguments Regarding OA 4: Claims 1, 3-6, 8-12, and 14

### - Aida (USPN 5221781) in view of Lloyd (USPN 6368529)

OA 4 at p4 : "Aida lacks sufficient specificity to anticipate the claimed range. However the claimed range would have been prima facie obvious over Aida's teachings to use the materials in combinations of two or more and to adjust these ranges, making the amount of zinc borate a result-effective variable."

Aida's desired result is a flame retardant composite. However the required loadings of either zinc borate or colemanite required to flame retard a polyolefin composite of amended Claim 1 would far exceed Lloyd's range of 0.1 to 4%.

a. O'Brien (USPN 5525757) teaches that flame retarding a polyolefin composite requires the addition of a halogen flame retardant, a non-halogen flame retardant, and a flame retardant intumescent. The halogen component is about 6 to 20 parts per hundred parts by weight of the polyolefin while the non-halogen is from about 20 to about 60 parts. (3:17-27). The non-halogen component is itself a mixture of two chemicals, the first of which is zinc borate from about 12 to 36 parts per hundred parts of the polyolefin (3:49-4:3) while the second is a magnesium hydroxide from about 8 to 24 parts per hundred parts of the polyolefin (4: 10-18).

O'Brien's claim 9 identifies the ranges of zinc borate require to flame retard a polyolefin composite. The minimum zinc borate percentage is 12/169 = 7.1%, where the 169 is composed of 100 parts polyolefin mixture, 20 parts chlorinated cyclooctene, 12 parts silicone modifier, 12 parts zinc borate, 24 parts magnesium hydroxide and 1 part hindered phenolic stabilizer. The maximum loading would be 36/156.2 =23.04%, where the 156.2 is composed of 100 parts polyolefin mixture, 6 parts chlorinated cyclooctene, 6 parts silicone modifier, 36 parts zinc borate, 8 parts magnesium hydroxide and 0.2 part hindered phenolic stabilizer.

One skilled in the art would not be motivated to use Lloyd's 0.1 - 4% range, which would be inadequate to meet the principle operation of flame retardancy. Further these ranges would leave Aida inoperable for its purpose of fire retardancy.

2. Touval (USPN3926883) states ""For non-halogenated polymers such as polyethylene and acrylonitrile- butadine –styrene tri-polymers, the preferred range is between 4 and 25 phr. Touval's Example 3 discloses that for polyolefins, the 4 percent is too low. Even the addition of 8 parts of chlorine wax, 2 parts of stannic oxide, and 8 parts of

zinc borate to a polyethylene resin only produce a Limiting Oxygen Index (LOI) of 20.5 (Table 2 -10:5-11), which is an unsatisfactory level. Touval explains that samples with an oxygen index of 21.0 or less will burn readily in air (9:61-64). Further, Table 2 discloses that doubling the amount of colemanite does not improve an improvement in the LOI of the polyethylene sample. Touval teaches that a colemanite loading of greater than 16 percent is required to provide adequate flame retardancy to a polyethylene composite.

Touval's Claim 1 and Examples 1 and 2 reference polyvinyl chloride and therefore do not apply to the claims of this amendment.

3. Applicant submits arguments presented in the 5-30-2008 (p 6-14) response regarding unexpected results and the additional arguments presented on this page transverse the obviousness rejection. These are summarized as follows:
    a. No prior art existed in Nov 2002 that described the mold resistance of a boron boron containing fungicide in a lignocellulosic thermoplastic composite.
    b. Zinc borate was thought by experts to be ineffective in resisting mold.
    c. Colemanite was shown to be ineffective in resisting mold in plastics [Koskiniemi (USPN 5482989].
    d. July 2005 filing on an international patent (WO/2006/0144280) by one of the inventors of USPN6368529 states that the addition of zinc borate to reduce UV degradation of resin composites was surprising.

**Arguments Regarding OA 5: Claims 1, 3-5, 6, 8, 9, 11, and 15**

**-Touval (USPN 3926883) in view of Pelikan (USPN 4104207)**

1. The arguments regarding valid ranges as presented above for OA 4 apply to OA 5.
2. Pelikan teaches a maximum of 23 percent lignocellulosic material. The total weight of the carrier and gas bubble medium is 5 to 25% (claim 30) and the gas bubble forming medium is 8 to 30% of this total (claim 31). The lignocellulosic material is the carrier (6:39) and the maximum amount is 0.92 x 25% = 23% of the thermoplastic resin. Even using a maximum of fillers at 50% of the thermoplastic material, the minimum amount of thermoplastic material is 100/173 = 57.8 percent which is significantly greater than the 25 percent minimum identified in this present invention.
3. The addition of lignocellulosic material would provide an unacceptable component to Touval's invention of a flame retardant composite containing Stannic Oxide. Holmes (USDA/FPL) in *Effect of Fire-Retardant Treatments on Performance Properties of Wood* identifies that Stannic Oxide stimulates glowing of burning wood. Glowing is the visual evidence of combustion of the carbon in the char layer of the burning wood. Wood that has been effectively treated should not exhibit any after-glow.
4. Claim 15 has been canceled.

**Arguments Regarding OA 6: Claims 1, 3-6, 8-12, 15, and 16**

**- Pelikan (USPN 4104207) in view of Lloyd (USPN 6368529)**

1. **MPEP 2143.01 (III):** The fact that references can be combined may not be sufficient to establish obviousness. There is no suggestion of wood preservation or the use of borates in Pelikan. The OA at page 7 states it would have been obvious to incorporated Lloyd into Pelikan to either (a) provide fungi and insect resistance or (b) act as a fire retardant. Neither scenario provides a valid motivation to incorporate borates at the 2 – 12% levels identified in this present invention.

(a) At the time of the invention, years of commercial use had shown that wood plastic composites are not attacked by insects while expert studies had demonstrated that zinc borate loadings of 1% would protect them from fungal decay. As a result there was no motivation to add 2 to 12 % to cover this scenario. Such levels were not required to resist decay and would have unnecessarily increased cost. At the time of the invention zinc borate was over $1/lb while wood was about 0.05/lb and plastic was from 0.40 to 0.55/lb.

When wood plastics were introduced the experts in the field believed that the plastic would totally protect the wood and there would be no fungal decay or insect attack. The latter proved to be correct; insects do not attack wood plastic products. It was discovered that under long duration outdoor exposure (an environment that lignocellulosic composites do not experience) wood plastic composites could experience some weight loss. University and government studies determined this was caused by wood decay. However their studies revealed that the plastic was providing significant, although not perfect, protection and as a result relatively low amounts of zinc borate were required to provide fungal resistance.

Verhey *(Laboratory Decay Resistance of Woodfibre Thermoplastic Composites,* 2001 IDS#1) writes: "Zinc borate has been shown to effectively protect the composites against fungal decay, in the laboratory environment, at loadings as low as 1 percent." Verhey's work included samples with 70 percent wood content.

(b) As described above, neither zinc borate nor colemanite are effective polyolefin flame retardants at the 0.1 -4% range.

2. Applicant's OA 4 arguments regarding unexpected results and OA 5 arguments regarding Pelikan apply to OA6.

**Arguments Regarding OA 7: Claims 1, 3-6, 15, and 16**

- **Pelikan (USPN 4104207) in view of Borogard ZB**

1. As noted above, Pelikan restricts the lignocellulosic component to 23% and the thermoplastic component to 57.8% which is significantly less than the range of the present invention's amended Claim 1.

2. PVC resin has been removed from the amended claims.

3. The Borogard ZB label was written in 1993 and all ranges provided were the best known for zinc borate at that time. At the time of the present invention one skilled in the art would have been aware of subsequent studies, such as Verhey, that determined a 1% loading of zinc borate adequately controlled decay in wood plastic composites.

Applicant argues that since Pelikan has no suggestion of wood preservation, there is not motivation to combine his teaching with Borogard ZB. However, assuming *arguendo* the OA position that one would have found motivation to make the combination, the 1% value would have been used and as was known at the time of the invention this level would have been successful.

For all the above reasons, as well as those presented in the previous amendments, Applicant respectfully submits the distinctions are of patentable merit. Accordingly Applicant submits this applications is now in full condition for allowance.

Respectfully submitted,

Stephen G. Bales
17 Hart Lane
Sewell, NJ 08080

**Appendix A**
**Claims**

1. (Currently Amended) In the method for forming lignocellulosic ~~thermoplastic~~ polyolefin composite products containing 25 to 75 percent by weight of the polyolefin material such as to increase their resistance to surface visual impairment caused by mold attack, the improvement which comprises incorporating an amount of a ~~boron containing fungicide~~ cationic salt of boric acid in the range of from about 2 to 12 percent by weight of said composite product prior to forming said composite product.
2. (Canceled)
3. (Currently Amended) The method according to claim 1 in which said amount of ~~boron-containing fungicide~~ cationic salt of boric acid is in the range of from about 3 to about 5 percent by weight of said composite.
4. (Original) The method according to claim 1 in which said lignocellulosic material is selected from the group consisting of wood, ground rice hulls, kenaf, jute, and coconut shells.
5. (Currently Amended) The method according to claim 1 in which said ~~thermoplastic~~ polyolefin material is selected from the group consisting of polyethylene, high density polyethylene, polystyrene, and ~~polyvinyl chloride~~ polypropylene.
6. ( Currently Amended) The method according to claim 1 in which said ~~boron-containing fungicide~~ cationic salt of boric acid is calcium borate.
7. (Canceled)
8. (Original) The method according to claim 6 in which said calcium borate is a naturally occurring borate.

9. ( Previously presented) The method according to claim 8 in which said calcium borate is selected from the group consisting of ulexite and colemanite.

10. (Currently Amended) The method according to claim 1 in which said ~~boron-containing fungicide is boric acid~~ polyolefin material is polyethylene or high density polyethylene.

11. (Canceled)

12. (Previously presented) The method according to claim 8 in which said calcium borate is colemanite.

13. (Canceled)

14. (Currently Amended) The method according to claim 1 in which said ~~boron-containing fungicide~~ cationic salt of boric acid is zinc borate.

15. (Canceled)

16. (Currently Amended) In the method for forming composite products consisting of a ~~thermoplastic~~ polyolefin material which is 25 to 75 percent by weight of the total composite, a lignocellulosic material, and at least one of the group consisting of a lubricant, a cross-linking agent, a UV stabilizer, a blowing agent, an inhibitor, and a coupling agent such as to increase their resistance to surface visual impairment caused by mold attack, the improvement which consists of incorporating an amount of a ~~boron-containing fungicide~~ cationic sale of boric acid selected from the group of ~~zinc borate~~, synthetic calcium borate, colemanite, ulexite, ~~boric acid,~~ or mixtures thereof in the range of from about 2 to 12 percent by weight of said composite product.

17. (Canceled)

18. (New) In the method for forming composite products consisting of lignocellulosic high density polyethylene and at least one of the group consisting of a lubricant, a cross-linking agent, a UV stabilizer, an inhibitor, and a coupling agent such as to increase their resistance to surface visual impairment caused by mold attack, the improvement which consists of incorporating an amount of synthetic calcium borate, colemanite, ulexite or mixtures thereof in the range of from about 3 to 5 percent by weight of said composite product prior to forming said composite product.